4.4 Radioactive Waste Management Complex

The Radioactive Waste Management Complex (RWMC) is located in the southwestern corner of the INEEL (see Figure 4-4). The facility encompasses a total of 177 acres and is divided into three separate areas by function: the Subsurface Disposal Area (SDA), the Transuranic Storage Area (TSA), and the administration and operations area. The mission of the facility from 1952 to 1970 was to manage disposal of radioactive waste. Since 1970, the mission has been to manage disposal of LLW and to store, treat, and prepare stored transuranic waste for off-Site shipment and disposal.

Figure 4-4. Aerial view of the Radioactive Waste Management Complex.

The RWMC facility is located in a depression surrounded by basaltic and lava ridges. The ground surface is relatively flat, and the elevation is about 5,000 ft above sea level. The Snake River Plain Aquifer lies beneath the facility at a depth of about 600 ft.

The SDA, comprising the western two-thirds of RWMC, is a disposal facility for radioactive waste. The original facility, established in 1952, covered 13 acres in the western portion of the SDA and was called the Nuclear Reactor Testing Station Burial Ground. The SDA currently is 97 acres in size and consists of 21 pits, 58 trenches, 21 soil vault rows, and an abovegrade asphalt pad (Pad A). Since 1952, 147,053 m^3 of nontransuranic waste, mainly from the INEEL, were disposed of at the SDA (DOE-ID 1998b). From 1954 through 1970, 67,460 m^3 of transuranic waste, mostly from the Rocky Flats Plant in Colorado, were disposed of at the SDA. Disposal of transuranic waste was discontinued in 1970, and disposal of mixed waste was discontinued by 1983. A portion of the SDA, Pits 17–20, is active and currently used for LLW disposal from operations on the INEEL Site.

The TSA was added to the east side of the SDA in 1970 and encompasses 58 acres. The TSA was first used to segregate and retrievably store waste with transuranic radionuclides, and this retrievable waste storage has been maintained since 1970. Waste stored in the TSA is being retrieved and prepared for transfer to the Waste Isolation Pilot Plant near Carlsbad, New Mexico. Presently, the TSA stores approximately 62,000 m^3 of transuranic waste in buildings and on covered, aboveground storage pads.

The 22-acre administration and operations area at RWMC includes administrative offices, maintenance buildings, equipment storage, and miscellaneous support facilities. These facilities support SDA and the TSA operations and maintenance at RWMC.

The following three RODs have been signed for RWMC:

- *Record of Decision: Declaration of Pit 9 at the Radioactive Waste Management Complex Subsurface Disposal Area at the Idaho National Engineering Laboratory* (DOE-ID 1993)—This ROD addresses interim action in Pit 9 at the RWMC SDA. The specified interim action is to retrieve transuranic and other waste buried in the pit. The *Agreement to Resolve Disputes, the State of Idaho, United States Environmental Protection Agency, United States Department of Energy* (DOE 2002d) established specific requirements for retrieval of waste and completion of the OU 7-13/14 ROD.

- *Record of Decision: Declaration for Organic Contamination in the Vadose Zone Operable Unit 7-08, Idaho National Engineering Laboratory, Radioactive Waste Management Complex, Subsurface Disposal Area* (DOE-ID 1994a)—This ROD addresses organic contamination in the vadose zone beneath RWMC. VOCs have migrated from organic waste buried in the SDA. The remedy provides for vapor vacuum extraction and treatment of organic vapors.

- *Record of Decision: Declaration for Pad A at the Radioactive Waste Management Complex Subsurface Disposal Area at the Idaho National Engineering Laboratory* (DOE-ID 1994b)—This ROD includes remedial actions to enhance, recontour, maintain, and monitor the soil and rock cover at Pad A and establishes long-term institutional controls at the site.

The comprehensive ROD for the entire RWMC, including the buried waste area, is currently scheduled to be issued in 2007.

4.4.1 Current State

Maps showing the current state of RWMC are provided in Figures 4-4a1a and 4-4a1b. The current mission of the facility is to manage, in a safe and environmentally sound manner, the disposal of low-level radioactive waste and the storage of transuranic waste. In addition, recent construction of the Advanced Mixed Waste Treatment Project will expand the RWMC's waste management operations to include treating and preparing the 62,000 m^3 of stored transuranic waste for shipment out of Idaho.

Active LLW disposal is ongoing within the SDA portion of RWMC. About 4,000–5,000 m^3 of low-level radioactive waste are disposed of at the SDA each year. Under the *Performance Management Plan* (DOE-ID 2002a), the goal is to continue disposal of contact-handled LLW through 2008 and to continue disposal of remote-handled LLW through 2009. The SDA is surrounded by a security fence.

Numerous measures are currently in place to limit the potential for occupational or public exposures to waste disposed of in the SDA. An air-monitoring network is in place to monitor airborne releases. Location-specific air and soil gas monitoring are also conducted in specific areas at the SDA. An extensive surface water management system, including dikes and drainage channels, has been implemented at the SDA to minimize the potential for flooding and releases by way of surface water. A variety of different modeling studies and research have been and continue to be conducted to assess the potential for contaminant migration and to focus monitoring and other protective measures on likely routes of potential exposure. Other controls include detailed procedures and safety reviews for all work to be conducted in the SDA, security fences and access controls, and land-use controls that restrict public access to the INEEL Site.

Site characterization activities include drilling wells for characterizing and monitoring purposes, sampling various aspects and features of the area, and characterizing waste. CERCLA remedial designs and actions to be performed include retrieval and treatment of waste from Pit 9 and treatment of volatile organic contamination in the vadose zone using vapor vacuum extraction technology. Long-term monitoring of the vadose zone and aquifer is being conducted to track trends in existing contamination and to provide information to assess contaminant release and migration.

Past disposal practices, once considered acceptable, are no longer acceptable under current regulations. The full extent of environmental contamination caused by the use of these former practices at RWMC is being investigated. Decisions to remediate the contamination will be based on regulatory requirements and risk to human health and the environment.

The TSA, a 58-acre area located in the southern section of the facility, is dedicated to the temporary storage of contact-handled and remote-handled transuranic waste. This area consists of the Advanced Mixed Waste Treatment Project and waste storage facilities.

In December 1996, DOE awarded a privatization contract for construction and operation of the Advanced Mixed Waste Treatment Project. The project's mission is to retrieve and treat about 62,000 m^3 of INEEL transuranic waste currently stored at the TSA. Facility operations will prepare the waste for shipment to New Mexico's Waste Isolation Pilot Plant in accordance with the *Settlement Agreement* (DOE 1995) between the State of Idaho, DOE, and U.S. Navy. The Advanced Mixed Waste Treatment Project is expected to begin operations in 2004. All operations will be completed no later than December 2018, after which the facility will undergo RCRA closure and DD&D.

Buried waste within the trenches, pits, and soil vault rows at the SDA poses a potential risk to human health by way of several pathways shown in the current state conceptual model (see Figure 4-4a2).

The nature and extent of contamination associated with the SDA in all environmental media will be presented in the OU 7-13/14 RI/FS. Initial human health and ecological contaminant screening has been performed and will be used to define contaminants for analysis.

The ongoing evaluation of nature and extent of contamination considers the following depth intervals: (1) the waste zone; (2) the vadose zone outside of the waste zone from depth intervals of 0 to 35 ft, 35 to 140 ft, and 140 to 250 ft; and (3) the vadose zone and aquifer at depths greater than 250 ft.

Some contaminants of concern have been detected at low concentrations in the vadose zone. Most vadose zone detections are in the 0- to 35-ft and 35- to 140-ft intervals (Olson et al. 2003). Contaminants of concern detected in the vadose zone are carbon tetrachloride, nitrates, carbon-14, and uranium isotopes. Other contaminants, including americium-241, tritium, iodine-129, plutonium-238, plutonium-239/240, strontium-90, and technetium-99, also have been detected in the vadose zone. Technetium-99 is regularly detected in one set of lysimeters at the west end of the SDA at concentrations around 10 times lower than the MCL. In addition, carbon tetrachloride is regularly detected in the vadose zone, though concentrations decrease significantly below 140 ft and again below the 250 ft. Because carbon tetrachloride migrates in the gaseous phase, it also has been detected hundreds of feet laterally away from buried waste but still within the boundaries of the INEEL (Holdren et al. 2002).

Carbon tetrachloride has been measured slightly above the MCL (5 µg/L) in the aquifer, with a one-time maximum value of 9 µg/L. Low concentrations of nitrate, carbon-14, and tritium, well below

MCLs, also have been detected in the aquifer near the SDA. Enough data have not been collected to determine a trend at this time.

The monitoring network at RWMC has been greatly expanded since 1998 with 22 additional vadose zone lysimeters, four upgradient aquifer wells, an aquifer well inside the SDA, and more than 300 probes in the buried waste. The expanded network will continue to produce data for ongoing evaluation of source release into the vadose zone, contaminant migration through the vadose zone, and potential impacts to the aquifer beneath the SDA. Monitoring data will also support future remediation by providing a baseline for remediation goals. Vadose zone water and gas monitoring is also being initiated in ports that have been recently installed within the active LLW disposal pit.

A vapor extraction system that extends deep into the vadose zone is used to mitigate VOC migration and release through the vadose zone to the aquifer. To implement the selected remedy described in the OU 7-08 ROD (DOE-ID 1994a), three vapor vacuum extraction with treatment units with recuperative flameless thermal oxidation were installed within the boundaries of the SDA and brought into full-scale operation in 1996. The original units have been replaced over time with newer extraction and catalytic oxidizer units. Data from representative monitoring well vapor samples are used to assess the effectiveness of the organic contamination in the vadose zone remedy and to optimize VOC mass removal.

The current conceptual site model considers hypothetical residential and occupational scenarios for the following exposure pathways: air inhalation, direct exposure, groundwater ingestion, food ingestion, soil ingestion, and crop ingestion (Holdren et al. 2002). Buried waste in the trenches, pits, and soil vault rows at the SDA poses unacceptable risk to human health as shown in the current state conceptual model. Residual soil contamination within the TSA also may require remediation.

4.4.2 End State

Current plans call for disposal of LLW in the SDA to be discontinued by 2009. A federal task force has been chartered to assess the viability of this plan as well as other alternatives for LLW disposal. Stored waste at the TSA will be retrieved and shipped off-Site by 2018. RWMC has not been identified to have a long-term NE mission. Therefore, it is anticipated that the buildings and infrastructure will be removed before 2035. No remediation will be required in the administration area beyond building demolition.

Under the FFA/CO, the final remedy for RWMC will be determined in the future. The enforceable schedule to complete the OU 7-13/14 comprehensive RI/FS for RWMC is to submit a draft remedial investigation/baseline risk assessment in August 2005, a draft feasibility study by December 2005, and a draft ROD by December 2006.

The feasibility study for the overall remediation of all buried waste in the RWMC will evaluate the full range of alternative remedial actions possible for the SDA and determine their comparative effectiveness, difficulty, cost, and other factors. As with any site with buried hazardous substances, the range of alternatives could include excavation and removal of all buried waste and disposal at another location; selective removal and redisposal elsewhere of some or all higher-risk waste, including some or all of the several acres containing transuranic waste; immobilization of waste, such as through in situ grouting, to prevent movement in the environment to other soil, air, or groundwater; use of earthen or artificial materials to cap the waste burial areas in order to limit infiltration of rain and snowmelt through the waste and subsequent transport of contaminants into the aquifer; and combinations of these approaches.

The completed draft feasibility study will be submitted for Idaho Division of Environmental Quality and EPA comment no later than December 2005. The revised, final feasibility study will be the basis for drafting a proposed plan and draft ROD that will undergo revision based on Idaho Division of Environmental Quality and EPA comments. The final ROD will address public comments and provide legally binding remedial decisions for the RWMC.

Since the final remedy has not yet been determined, no end state maps or end state conceptual site models are provided. The final selection of a remedial action must await completion of the ROD for OU 7-13/14.

4.4.3 Variances

No potential variances related to RWMC have been identified, as the remedial action for OU 7-13/14 has not yet been selected.

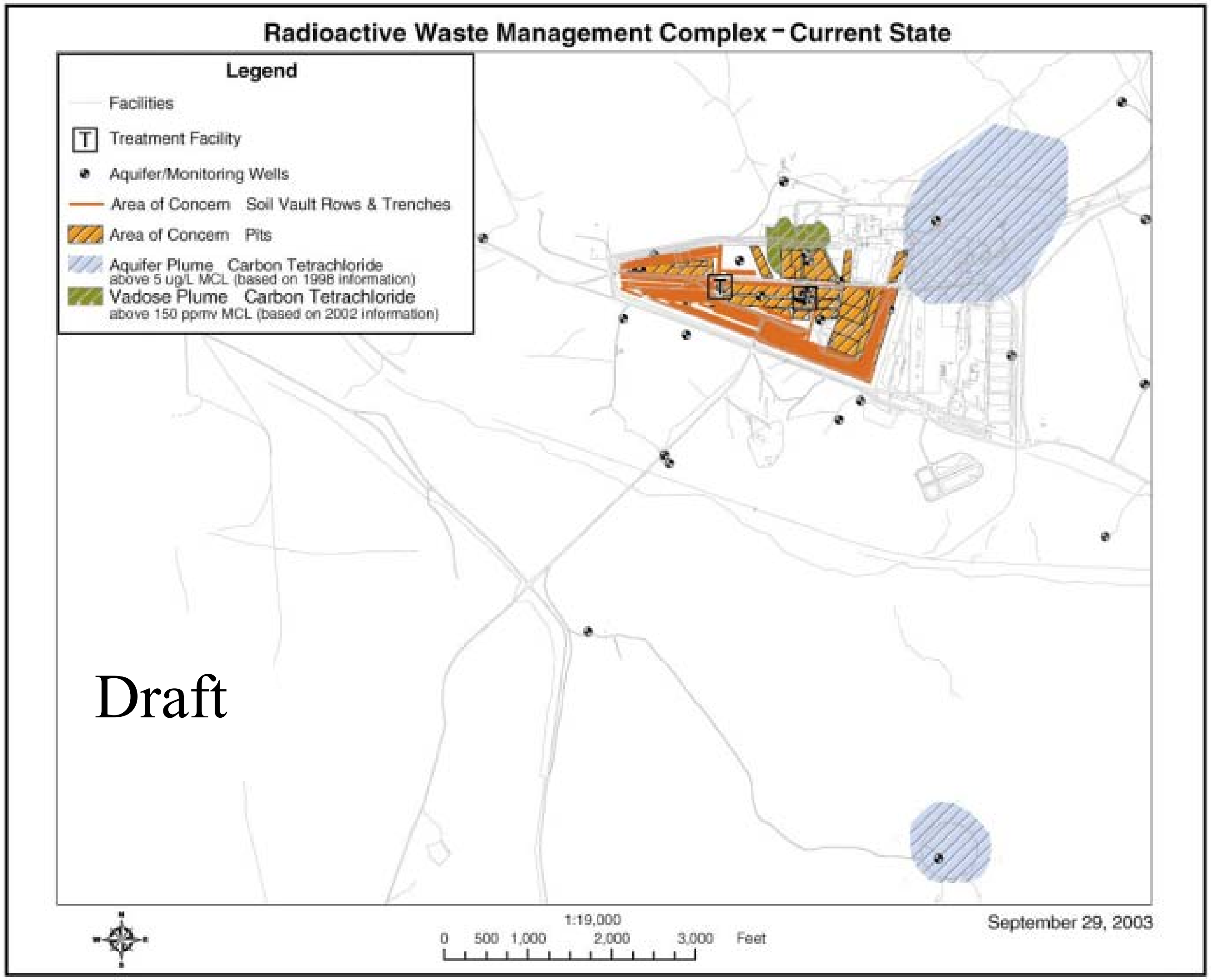

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Figure 4-4a1a. Radioactive Waste Management Complex map—current state.

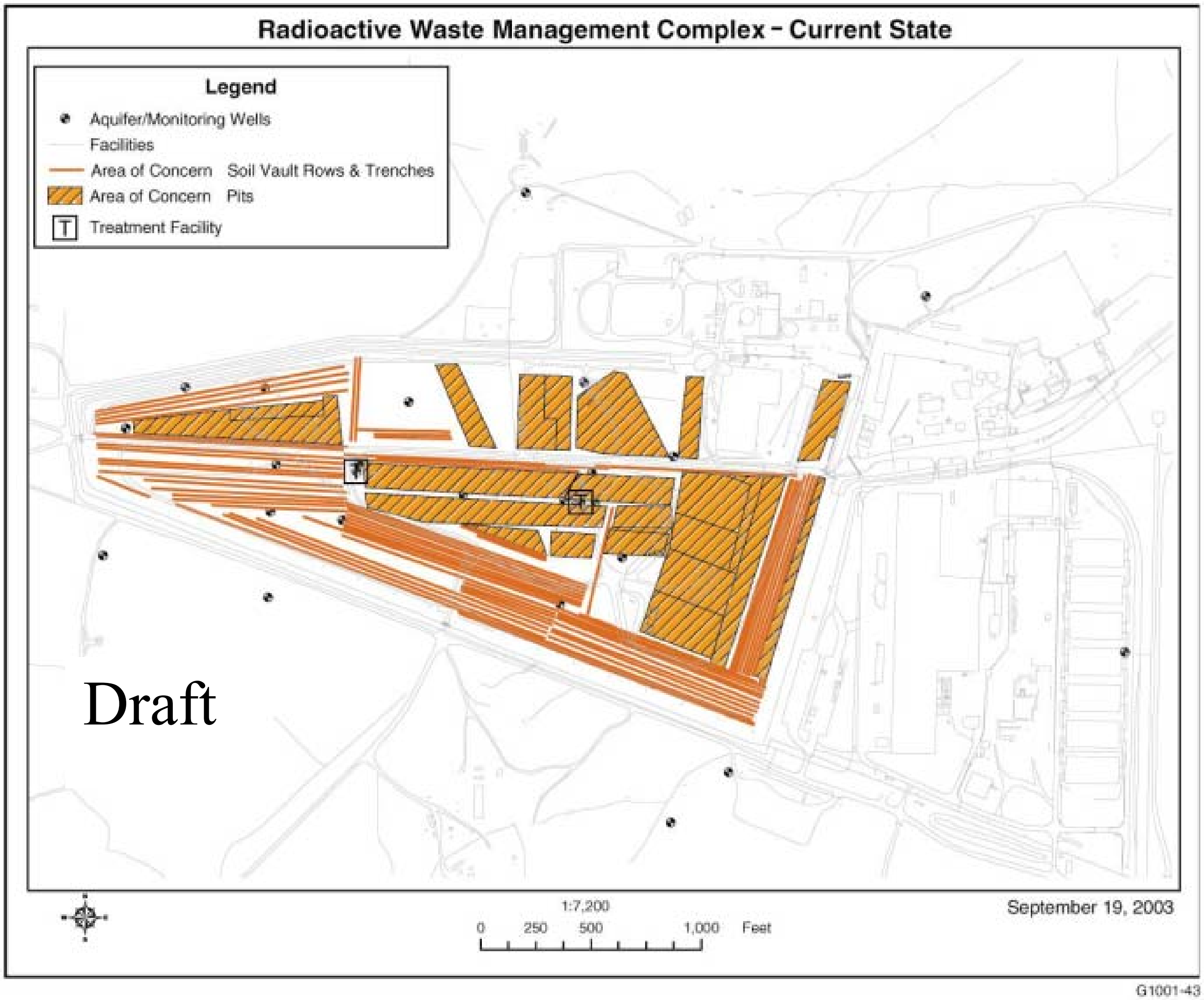

Figure 4-4a1b. Radioactive Waste Management Complex facility detail map—current state.

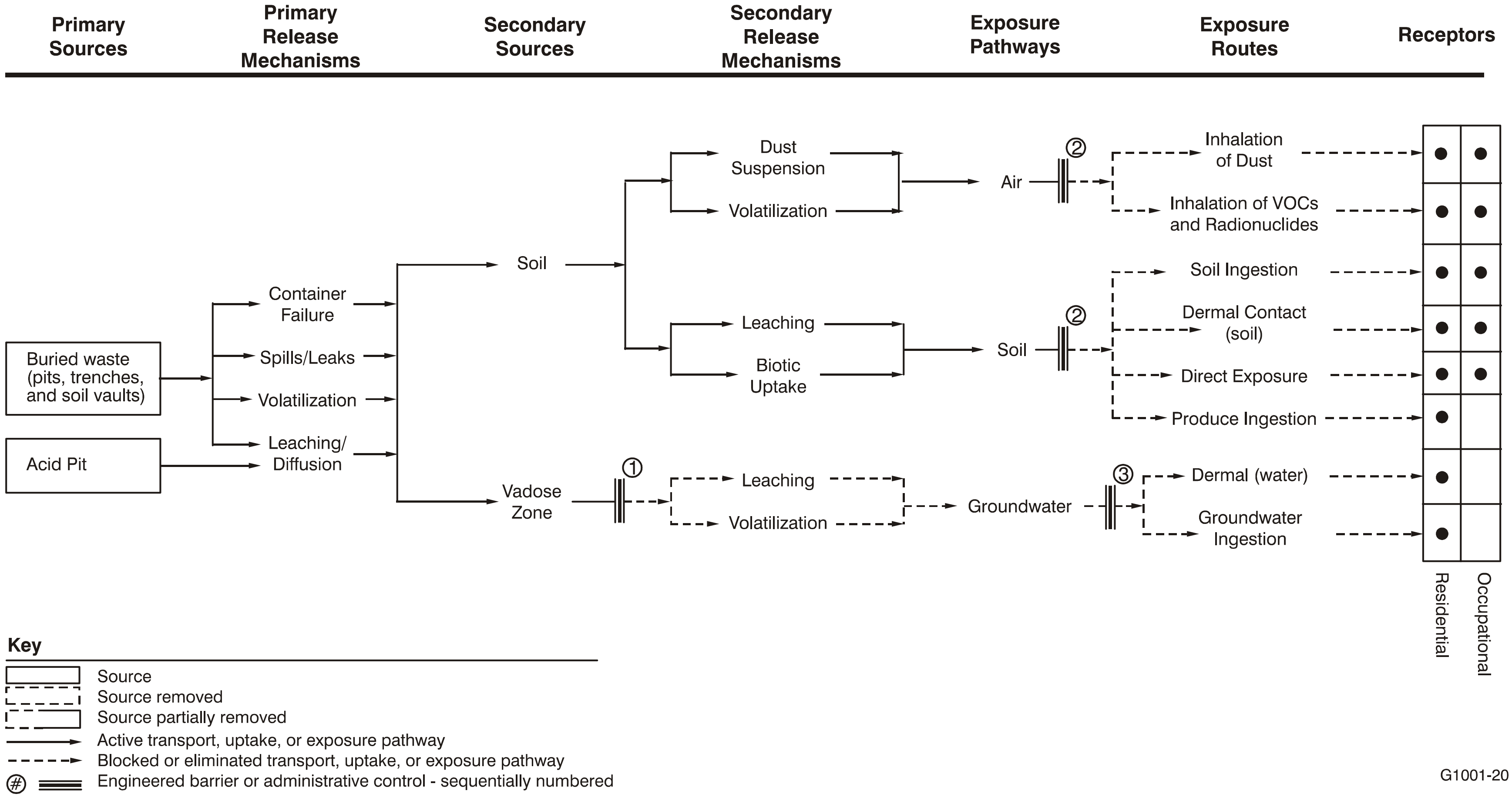

Figure 4-4a2. Radioactive Waste Management Complex conceptual site model—current state.

Narrative for Figure 4-4a2 Radioactive Waste Management Complex Conceptual Site Model—Current State

The primary area of concern at the RWMC is the SDA. The SDA is 97 acres in size and consists of 21 pits, 58 trenches, and 21 soil vault rows. The SDA was used as a land disposal facility for radioactive and mixed waste from 1952 through the present. Disposal of transuranic waste was discontinued in 1970, and disposal of mixed waste was discontinued in 1983. A portion of the SDA, Pits 17–20, is still active and used for LLW disposal from operations on the INEEL Site.

The Acid Pit received liquid organic and inorganic waste from 1954 to 1961. Some of the waste was contaminated with low-level radioactivity. Typically, liquid waste was poured directly into the pit. Lime was sometimes added to neutralize acids. Closure operations in 1961 included filling the pit with a soil cover to match the local gradient and revegetation. In 1997, as part of a CERCLA treatability study, portions the Acid Pit site were grouted with approximately 3,300 gal of grout. At this time, all that remains of most of the contamination at the Acid Pit is a grout monolith (Holdren et al. 2002).

VOCs (i.e. carbon tetrachloride, methylene chloride, and tetrachloroethylene) and nitrates pose the most imminent risk. Carbon tetrachloride has been detected in the aquifer slightly above the MCL and is being extracted from the vadose zone to reduce risk. Mobile long-lived fission and activation products are the next most immediate concern.

The steps taken to mitigate or remove these hazards are as follows:

1. A vapor extraction system that extends deep into the vadose zone is used to mitigate VOC migration and release through the vadose zone to the aquifer. To implement the selected remedy described in the OU 7-08 ROD (DOE-ID 1994a), three vapor vacuum extraction with treatment units with recuperative flameless thermal oxidation were installed within the boundaries of the SDA and brought into full-scale operation in 1996. The original units have been replaced over time with newer extraction and catalytic oxidizer units. Data from representative monitoring well vapor samples are used to assess the effectiveness of the organic contamination in the vadose zone remedy and to optimize VOC mass removal.

2. The entire INEEL Site has restricted access to prevent intrusion by the public. In addition, the RWMC site and surrounding area end state will include restricted industrial surface and groundwater use with appropriate institutional controls to address remaining hazards until such time as acceptable risk levels for unrestricted use are attained. The SDA is surrounded by a security fence. Workers are protected through posting of signs at contaminated sites, by recording contaminated sites in the Site institutional controls database, through radiological control training, and through the work control process used to identify hazards and mitigation measures for planned work activities. An air-monitoring network is in place to monitor airborne releases. Location-specific air and soil gas monitoring are also conducted in specific areas at the SDA. An extensive surface water management system, including dikes and drainage channels, has been implemented at the SDA to minimize the potential for flooding and releases by way of surface water. Other controls include detailed procedures and safety reviews for all work to be conducted in the SDA.

3. The entire INEEL Site has restricted access to prevent intrusion by the public. Other institutional controls include signs and permanent markers, control of activities (drilling and excavation), and publication of surveyed boundaries and descriptions of controls in the Site institutional controls database. An extensive groundwater-monitoring program is in place at RWMC. Drinking water wells used to supply potable water to the work force are located outside of the SDA and are routinely monitored for water quality. No contamination in the aquifer has been detected beyond the Site boundary.